REMARKS

I. Status of the application

Claims 1-18 are pending. Claims 1-14 and 17-18 have been rejected by the Examiner. The Examiner has objected to claims 15 and 16 but indicated those claims contain allowable subject matter. Applicants appreciate the indication of allowable subject matter.

II. Claim objections

The Examiner has objected to claim 6 as being in improper dependent form because the claim term "methane gas," recited in claim 1, does not provide antecedent support for the claim language "methane or a mixture of methane and a carrier gas," recited in claim 6. Applicants have amended claims 1, 6, 9 and 13 by changing the term "methane gas" to "methane gas composition," thus providing appropriate support for claim 6.

The Examiner has also objected to claims 5, 10 and 14-16 as reciting the term "ratio" when the specification teaches that this ratio is a molar ratio. While Applicants believe one skilled in the art would understand the meaning of this term in view of the disclosure in the specification, Applicants have amended the claim term "ratio" to "molar ratio" in the objected-to claims.

III. Rejection under 35 U.S.C. § 103(a)

The Examiner has rejected claims 1-14 and 17-18 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,333,016 ("Resasco") in view of a Hernadi *et al.* article entitled, "Fe-Catalyzed Carbon Nanotube Formation" ("Hernadi"). The Examiner states that Resasco teaches Applicants' claimed invention except that Resasco does not list iron, a known Group VIII metal catalyst, with the list of acceptable Group VIII metals in col. 4, lines 55-56. Hernadi, according to the Examiner, teaches the synthesis of carbon nanotubes using iron catalysts. Thus, the Examiner concludes, it would have been obvious to one of ordinary skill in the art at the time of the invention to include iron metal as an acceptable Group VIII metal in a carbon nanotube growth catalyst.

While the Examiner is correct that Resasco does not list iron as an acceptable Group VIII metal, the Examiner is incorrect in the inference that Resasco inadvertently omitted iron from the list of acceptable Group VIII metals. In actuality, Resasco explicitly excludes iron from the list of acceptable Group VIII metals disclosed in the specification. See col. 3, lines 6-8 ("the metallic catalytic particle includes a Group VIII metal, *excluding iron*, and a Group VIb metal") emphasis added. Resasco's exclusion of iron as an acceptable Group VIII metal is also readily apparent from the lists of group VIII metals in Resasco's Abstract and in col. 4, lines 52-65, neither of which include iron.

Furthermore, that Resasco intended to exclude iron is made clear by what Resasco has claimed as the invention. In independent claims 15, 24, 32, 40, 48, 56, 65, 74, 101 and 102--a total of ten independent claims, Resasco explicitly *excludes* iron as a possible Group VIII metal. No other claim includes iron. Therefore, the Resasco method of producing carbon nanotubes clearly relates to a process that does not use iron.

By explicitly excluding iron--and only iron--from the list of acceptable Group VIII metals, Resasco effectively teaches away from using iron-containing catalysts to produce carbon nanotubes. Since Resasco teaches away from using iron, one skilled in the art would not use iron in the place of a listed Group VIII metal. For this reason, one of ordinary skill would not have found Applicants' claimed invention obvious from Resasco. Moreover, since Resasco teaches away from using iron, it is improper to combine Resasco with another prior art document for the purposes of demonstrating that iron may be substituted with a Resasco Group VIII metal. See *Winner International Royalty Corp. v. Wang*, 202 F.3d 1340, 53 USPQ2d 1580 (Fed. Cir. 2000) (when a first prior art reference teaches away from a second reference, then that finding alone can defeat an obviousness claim based upon a combination of the two references).

Hernadi, the secondary reference relied upon by the Examiner, does not teach or suggest Applicants' claimed invention by itself or in combination with Resasco. Hernadi relates to a process of synthesizing carbon nanotubes in the catalytic decomposition of acetylene, ethylene and propylene in the temperature range of 650-800° C over supported iron catalysts. See page 1249, first sentence under the heading "experimental." While the Hernadi process may be useful

for producing carbon nanotubes using acetylene, ethylene or propylene, Hernadi explicitly teaches that when methane was used with these process conditions, the formation of carbon nanotubes was zero ("no carbon deposit could be weighed"). See pages 1254-55, section 3.4, and especially lines 9-13 on page 1255 ("Fe/silica was almost inactive in the decomposition of methane even at 800° C. At this reaction temperature no carbon deposit could be weighted, but a very small amount of soot has been observed by electron microscopy."). Thus, the Hernadi process does not relate to a process for preparing carbon nanotubes using a *methane* gas composition and an iron-containing catalyst, as claimed in Applicants' invention. Additionally, since the Hernadi process has been shown to be ineffective for preparing carbon nanotubes using methane, one skilled in the art would not combine the process conditions disclosed in Hernadi with another reference that relates to preparing carbon nanotubes using methane.

Just as Resasco teaches away from a process of preparing carbon nanotubes using an iron catalyst, Hernadi teaches away from a process of preparing carbon nanotubes using methane. Yet both of these features are claimed in Applicants' invention. Applicants examples demonstrate the successful production of carbon nanotubes according to the claimed invention. Resasco combined with Hernadi, or each of these references taken individually, does not teach or suggest Applicants' claimed invention. Accordingly, Applicants respectfully request that the Examiner withdraw the § 103(a) rejection.

IV. Conclusion

Applicants respectfully request reconsideration of this application in view of the above amendment and remarks.

Attached hereto is a marked-up version of the changes made to the claims by the current amendment. The attached page is captioned, "Version with markings to show changes made."

Except for issue fees payable under 37 C.F.R. §1.18, the Commissioner is hereby authorized by this paper to charge any additional fees during the entire pendency of this application including fees due under 37 C.F.R. §§1.16 and 1.17 which may be required,

including any required extension of time fees, or credit any overpayment to Deposit Account No. 50-0310. This paragraph is intended to be a **CONSTRUCTIVE PETITION FOR EXTENSION OF TIME** in accordance with 37 C.F.R. §1.136(a)(3).

Respectfully submitted,

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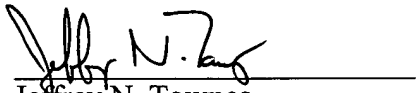

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

1. (amended) A chemical vapor deposition process for the preparation of a single-wall carbon nanotube, comprising:

providing a methane gas composition and a supported iron-containing catalyst to a chemical vapor deposition chamber, and

decomposing the methane gas composition in the presence of the supported iron-containing catalyst, under a sufficient gas pressure and for a time sufficient, to grow single-wall carbon nanotubes at a temperature from about 670° C to about 800° C.

5. (amended) A process of claim 4, wherein the supported iron-containing catalyst is Al_2O_3/Fe/Mo catalyst, and wherein the catalyst has a molar ratio of Al_2O_3:Fe:Mo of about (10-20) : 1 : $^1/_3$.

6. (amended) A process of claim 1, wherein said methane gas composition is methane or a mixture of methane and a carrier gas.

9. (amended) A chemical vapor deposition process for the preparation of single-wall carbon nanotubes, comprising:

providing a methane gas composition and an Al_2O_3/Fe/Mo catalyst to a chemical vapor deposition chamber, and

decomposing the methane gas composition in the presence of the Al_2O_3/Fe/Mo catalyst, under a sufficient gas pressure and for a time sufficient, to grow single-wall carbon nanotubes at a temperature from about 670° C to about 800° C,

wherein said single-wall carbon nanotubes have a diameter distribution ranging from about 0.7 nm to about 2.1 nm.

10. (amended) A process of claim 9, wherein the Al_2O_3/Fe/Mo catalyst has a molar ratio of

Al_2O_3:Fe:Mo of about (10-20) : 1 : $^1/_3$.

13. (amended) A chemical vapor deposition process for the preparation of single-wall carbon nanotubes, comprising:

providing a methane gas composition and an Al_2O_3/Fe/Co/Mo catalyst to a chemical vapor deposition chamber, and

decomposing the methane gas composition in the presence of the Al_2O_3/Fe/Co/Mo catalyst, under a sufficient gas pressure and for a time sufficient, to grow single-wall carbon nanotubes at a temperature from about 680° C to about 800° C

wherein said single-wall carbon nanotubes have a diameter distribution ranging from about 0.7 nm to about 2.1 nm.

14. (amended) A process of claim 13, wherein the Al_2O_3/Fe/Co/Mo catalyst has a molar ratio of Al_2O_3:Fe:Co:Mo of about (10-20) : 1 : 0.23 : $^1/_6$.

15. (amended) A process of claim 13, wherein the Al_2O_3/Fe/Co/Mo catalyst has a molar ratio of Al_2O_3:Fe:Co:Mo of about (10-20) : 1 : 0.23 : $^1/_{18}$.

16. (amended) A process of claim 13, wherein the Al_2O_3/Fe/Co/Mo catalyst has a molar ratio of Al_2O_3:Fe:Co:Mo of about (10-20) : 1 : 0.23 : $^1/_{36}$.